REMARKS

As an initial matter, Applicants note that the Office Action Summary indicates that the Office Action is responsive to a communication filed on October 10, 2007. For the record, Applicants timely filed a response with a one-month extension on October 4, 2007, not October 10, 2007. The following remarks are respectfully submitted.

Applicants have amended claim 1 to more sharply recite the claimed invention by essentially rewriting dependent claim 10 as if written in independent form, including the elements of intervening claims 8 and 9. Applicants have, accordingly cancelled dependent claims 8, 9, and 10. Further, Applicants have amended claim 1 to recite a "sacrificial protective coating."

Applicants have amended claim 11 to recite graphite. Applicants have amended claim 13 to recite "sacrificial protective coating." Applicants have canceled claims 25, 26, and 29. Applicants have amended claims 27 and 28 to depend from claim 1. Applicants have further amended claim 28 to recite elements of amended claim 1. Applicants have canceled claims 30 and 31. Applicants have amended independent claim 32 to recite that the Si/Ru protective coating is formed "prior to placing a substrate on the substrate heater" as is recited in claim 35.

Applicants have added new claims 36, 37, and 38. Claim 36 depends directly from claim 35. Claim 36 recites removing the substrate and stripping the sacrificial protective coating from the ceramic substrate heater. Claim 37 depends from amended claim 1 and recites that the protective coating substantially covers the exposed surfaces of the ceramic substrate heater. Claim 38 depends from claim 1 and recites repeating (a) through (f) of claim 1 at least once.

These amendments find support in the originally-filed specification, drawings, and claims: for example, paragraphs [0034] and [0045], original claim 31, or FIGS. 6B and 6D. Accordingly, Applicants believe that no new matter has been added by these amendments.

35 U.S.C. §102(e)

The Examiner has rejected claims 1, 11, 12, 15, 16, and 23 under 35 U.S.C. §102(e) as being anticipated by Ohashi et al. U.S. Patent Application Publication No. 2003/0064225. Claims 1 and 11 are currently amended. Claims 11, 12, 15, 16, and 23 depend from amended claim 1. As stated above, Applicants have amended claim 1 to include the elements of claims 8-10, thus essentially rewriting claim 10, in independent form. The Examiner admits with respect to original claim 8 that Ohashi does not teach depositing a second layer of metal on the second surface portion of the non-metal layer surface portion. (See Office Action ¶11, p. 4) Since Applicants have amended claim 1 by rewriting claim 10 in independent form thereby incorporating claim 8, Ohashi admittedly does not teach each and every element of amended claim 1. Thus, Ohashi does not anticipate amended claim 1. It follows then that claims 11, 12, 15, 16, and 23 are not anticipated by Ohashi either. It is thus respectfully requested that the rejection under §102(e) over Ohashi be withdrawn.

35 U.S.C. §103(a)

The Examiner rejects claims 8, 25, 28, and 29 under §103(a) as being unpatentable over Ohashi in view of Leung et al. U.S. Patent No. 5,705,080. The Examiner rejects claims 9, 10, and 26 under §103(a) as being unpatentable over Ohashi in view of Leung, and further in view of U.S. Patent No. 5,952,060 to Ravi. As noted above, Applicants have amended claim 1 by essentially rewriting claim 10 in independent form, including the elements of intervening claims 8 and 9. Further, Applicants have amended claim 10 to recite a "sacrificial protective coating." Applicants have, accordingly, canceled claims 8, 9, and 10. Claims 25, 26, and 29 are canceled making the rejection of these claims moot. Applicants submit that amended claim 1 and dependent claim 28 are nonobvious over the references of record.

With respect to amended claim 1 (formerly claims 8, 9, and 10), to support an obvious rejection, there must be some articulated reasoning with some rational underpinning.

(See M.P.E.P. §2143.) In particular, with respect to original claim 8, the Examiner admits that Ohashi "does not teach the method wherein the process is a process during which a second layer of the metal is deposited on the second surface portion of the non-metal layer surface portion." (See Office Action, ¶ 11, p. 4.) The Examiner cites Leung as disclosing what Ohashi admittedly does not teach. The Examiner describes Leung as disclosing forming a seasoning protective coating on a substrate heater that is of the same metal that is to be deposited on a substrate. (See Office Action, ¶ 11, p. 4.) The Examiner, however, fails to articulate a reason why one skilled in the art would modify Ohashi with Leung. Applicants submit that a reason does not exist because Leung and Ohashi teach away from their combination, and, for at least this reason, one skilled in the art would not modify Ohashi with Leung.

Ohashi is directed to "corrosion-erosion resistant" members (see Abstract). Ohashi provides ample evidence that a diamond-coated member is corrosion-erosion resistant. Because of its excellent corrosion-erosion resistance, the diamond coating is more or less a permanent coating on the substrate heater, protecting the substrate heater from harsh cleaning gases. The diamond coating, furthermore, keeps the substrates "clean" because the diamond coating allows frequent aggressive cleaning gases to be used to clean deposits from the substrate heater without deterioration of the substrate heater itself. Therefore, the environment in which the substrates are processed is cleaned more often during processing of a large number of substrates without negatively impacting the life of the substrate heater.

By contrast, rather than disclosing a protective layer that resists cleaning gases (i.e. Ohashi), Leung discloses a method of using a covering wafer to protect the substrate heater from cleaning gases. The covering wafer is positioned on an aluminum or aluminum alloy heater plate prior to cleaning. The covering wafer, not a deposited coating, protects the heater metal from the cleaning gases. Once the chamber is clean, the cover plate is removed prior to processing substrates. In Leung, substrates are not processed on the covering wafer. Thus, the process in

Leung is distinct from, and incompatible with, Ohashi, where the corrosion-erosion resistant layer is not removed and on which substrates are actually processed.

Additionally, unlike Ohashi's ceramic heater plate, in Leung, the heater plate is a metal. Further, Leung teaches that insulating materials in a layer on the metallic substrate heater degrade wafer processing, particularly the rate and uniformity of film deposition on the wafer. (See column 2, ll. 5-8.) Applicants submit that, for at least these reasons, Leung teaches anyway from using ceramic substrate heaters and depositing coatings on the substrate heater as disclosed in Ohashi.

Continuing, neither Ohashi nor Leung disclose or suggest depositing a layer of metal onto a nonmetal as is recited in amended claim 1. The Examiner, however, relies on Leung for disclosing a tungsten seasoning layer. Applicants submit that neither Ohashi nor Leung suggest depositing the seasoning layer on a non-metal layer as the Examiner suggests. In Leung, the seasoning layer is deposited only after cleaning to ensure a "more uniform semiconductor wafer processing environment." (See column 8, ll. 46-47.) The seasoning layer, therefore, is deposited directly onto a *metal* heater plate. In addition, Leung discloses that subsequent metal depositions on the second surface portion result in metal-on-metal layering, not a metal-on-non-metal layering as claimed. Furthermore, metal-on-metal layering is more likely to result in bonding of the metal layers and ultimately flaking and contamination (see Leung, column 1, lines 30-32). Metal-on-metal layering is markedly different from the non-metal-on-metal layering as recited in amended claim 1.

On another note, Applicants point out that Ohashi goes to great lengths to avoid contamination of the diamond coating from metals, like tungsten. Ohashi discloses that diamond is selected as a corrosion-erosion resistant member because "it does not cause contamination of metal ions." (See Ohashi, ¶ [0022].) Furthermore, at paragraph [0035], Ohashi lists elements, including metals like tungsten, that are preferably "50 one millionth or less of the total weight of the thin film in order to prevent the film from contamination with metal." So, seasoning the

corrosion-erosion resistant diamond coating of Ohashi with tungsten metal, per the Examiner's explanation, prior to processing substrates on the diamond coating, wholly defeats the purpose of Ohashi. For at least these additional reasons, Leung is an inappropriate reference and one skilled in the art would not modify Ohashi based on what Leung teaches, nor would one skilled in the art combine Ohashi with Leung in any way. Applicants submit that amended claim 1 is nonobvious over Ohashi in view of Leung.

With respect to amended claim 1 (original claims 8, 9, and 10), the Examiner alleges a combination of Okashi, Leung, and Ravi. Both Ravi and Ohashi are directed to corrosion-erosion resistant coatings, like diamond and diamond-like carbon (DLC). These coatings are deposited onto the substrate heater for a primary purpose of resisting gases used, like cleaning, processing, etching, and depositing gases. For example, in Ohashi, for testing purposes, diamond coatings were exposed to various gases for a period of about 2 hours. The diamond coatings exhibited significant resistance to removal even when subjected to these harsh conditions as is evidenced in Ohashi at TABLE 1. Likewise, Ravi discloses diamond and diamond-like carbon coatings that

> proved resistant to chemical attack, including attack by ionized gaseous species. Below temperatures of about 600ºC, the components [coated with the diamond coatings] resisted attack by molecular and atomic oxygen, molecular and activated etch gases such as NF_3 and CF_4, and other process gases commonly used in substrate processing. (See column 11, ll. 27- 33.)

One benefit of the diamond coating is that the basal material is protected from the cleaning gases during chamber cleaning. (See Ohashi ¶ [0021] and Ravi, column 11, line 64.) In particular, for example, one of the objects of Ohashi is to "provide a diamond-coated member that is *fully resistant* against more corrosive gas, more powerful plasma or the like in a harsher corrosive atmosphere of a semiconductor producing process . . . ." (Emphasis added, see ¶[0025].) And from Ravi, "it is believed that such components [having diamond coatings according to the present invention] will have virtually limitless lifetimes." (See column 11, lines 62- 64.) It is clear

in both Ohashi and Ravi that their protective coatings are not sacrificial coatings that are to be stripped from the heater after a desired number of substrates have been processed, but rather, are permanent coatings. Further, in Ravi, DLC coatings are reapplied over existing DLC coatings at an interval determined by a predetermined number of substrates processed or based on physical measurements. Specifically, the DLC coating is reapplied when the existing carbon-based coating experiences substantial erosion caused by processing operations. (See column 10, ll. 6-10.) However, in neither reference is the diamond coating stripped from the ceramic substrate heater as recited in amended claim 1. For at least this additional reason, Applicants submit that amended claim 1 is nonobvious over Ohashi in view of Leung in further view of Ravi. Claim 28 depends from amended claim 1. It follows then that claim 28 is nonobvious over Ohashi in view of Leung in further view of Ravi. Therefore, it is respectfully requested that the rejection of claims 1 and 28 be withdrawn.

The Examiner rejects claims 13 and 24 under §103(a) as being unpatentable over Ohashi in view of EP Patent Application Publication No. 0440384 to Sussmann. Claims 13 and 24 depend from amended claim 1, which now includes the elements of claims 8-10. The Examiner cites Sussmann as disclosing (i) chromium as a metal layer between a ceramic substrate and a diamond layer and (ii) heating the substrate to temperatures of around 300°C during forming of the chromium-containing metal layer with the diamond layer bonded to the chromium. Sussmann, however, does not cure the deficiencies of the alleged combination of the teachings of Ohashi, Leung, and Ravi with respect to original claim 10, now amended claim 1. Applicants respectfully submit that claims 13 and 24 are nonobvious over a combination of these references, and it is thus respectfully requested that the rejection be withdrawn.

The Examiner rejects claim 14 under §103(a) as being unpatentable over Ohashi in view of Sussmann, and further in view of Ludwig et al. U.S. Patent No. 4,248,943. Claim 14 depends from amended claim 1, which now includes the elements of claims 8-10. The Examiner cites Ludwig as describing deposition of chromium metal from a chromium carbonyl precursor.

Ludwig does not cure the deficiencies of the alleged combination cited in the rejection of original claim 10, now amended claim 1. Claim 14 is therefore nonobvious over the references cited, and it is respectfully requested that the rejection be withdrawn.

The Examiner rejects claims 30 and 31 under §103(a) as being unpatentable over Ohashi in view of Ravi. Applicant has canceled claims 30 and 31 making the Examiner's rejection of these claims moot.

Claim 27 is rejected under §103(a) as being unpatentable over Ohashi in view of Leung and Ravi, and further in view of Sussmann. Claim 27 is currently amended to depend from amended claim 1. Applicants note that the portion of Sussman that the Examiner refers to emphasizes improving the bond between a diamond coating and a metal bonding layer. Essentially, adding silicon between the diamond coating and metal bonding layer increases the resistance of the diamond layer to environmental attack. That is, Sussmann discloses how to improve the permanency of the diamond coating. Therefore, like Ohashi and Ravi, Sussmann teaches away from Leung (i.e. stripping of the diamond coating). For similar reasons provided in response to the Examiner's rejection over Ohashi in view of Leung and Ravi, Sussmann teaches away from combination with, or modification by, Leung. Consequently, Sussmann cannot cure the deficiencies of the alleged combination. Claim 27 is nonobvious over the alleged combination of Ohashi in view of Leung and Ravi, and further in view of Sussmann. It is thus respectfully requested that the rejection be withdrawn.

The Examiner rejects claims 18 and 35 under §103(a) as being unpatentable over Itatani et al. U.S. Patent Application Publication No. 2002/0072211 in view of Kim et al. U.S. Patent No. 6,413,321, Fukuda et al. U.S. Patent Application Publication No. 2001/0037769, Nakajima U.S. Patent No. 6,452,775 and Vaartstra et al. U.S. Patent No. 6,197,628. Claim 35 is an independent claim with claim 18 depending therefrom. Applicants respectfully traverse the rejection.

To support an obvious rejection, there must be some articulated reasoning with some rational underpinning. (See M.P.E.P. §2143.) Here, the Examiner has recited two additional references together with three references cited in the prior office action. While the references disclose depositions of films onto various substrate heater and chuck materials, their combination or modification is not suggested in the references and is not supported by the reasoning provided by the Examiner. Furthermore, even if taken together, the references fail to disclose all of the elements of claim 35, and the Examiner fails to provide a rationale to explain why what is not disclosed would be obvious to one skilled in the art at the time of the invention.

Itatani merely describes deposition of ruthenium-containing films during processing of substrates and subsequent removal of the ruthenium-containing films. Itatani is silent as to substrate heater material. In pertinent part, Itatani discloses precoating of a ruthenium-containing film onto a substrate subsequent to a cleaning operation utilizing a ClF_3 gas in a non-plasma thermochemical reaction. The "nonplasma" system reduces hardware cost and overcomes a lack of uniformity of etching in areas outside a typical plasma cleaning system. The Examiner then references Kim. Kim describes an oxide-seasoning layer formed after a chamber cleaning operation to trap contaminants. Kim discloses specific oxides of silicon, in particular Si_xO_y or $Si_xO_yN_zH$. (See column 7, ll. 63-65 and Table 1.) The Examiner then states "it would have been obvious to one having ordinary skill in the art . . . to have modified the method taught by Itatani by first forming a protective coating." Applicants submit that modification of Itatani with Kim, as the Examiner has suggested, provides "a protective coating" of a silicon oxide seasoning layer described by Kim. The ruthenium-containing layer from Itatani is then formed on the silicon oxide seasoning layer. That is, Examiner's alleged modification of Itatani produces a ruthenium-containing layer on a silicon oxide seasoning layer. Applicants note that this order is reversed from the order recited in claim 35.

The Examiner admits that the alleged modification of Itatani in view of Kim does not disclose a ceramic substrate heater. (See Office Action ¶ 31.) The Examiner relies on Fukuda

for disclosing the ceramic substrate heater. However, Fukuda discloses "the surface layer has an electrical resistivity lower than that of the base material of the susceptor 3." (See ¶ [0035].) Fukuda discloses the base material of the susceptor as one of AlN, Al_2O_3, or the like (see ¶ [0030]). Taking Fukuda as a whole, Fukuda suggests that the surface layer in the alleged combination of Itatani and Kim is conductive (i.e., it requires ruthenium as the surface layer), which is consistent with Examiner's reasoning recited above. Furthermore, silica is a known insulator and depositing it on the ruthenium-containing layer would cause at least one problem that Fukuda is attempting to prevent. For at least these reasons, Examiner's alleged modification suggests that the ruthenium- layer (rather than the "ruthenium-containing" layer) is the layer on which substrates would be processed. So, thus far, the Examiner's reasoning creates something that is altogether different from what Applicants have recited in claim 35.

Next, the Examiner references Nakajima as disclosing that ceramic layers contain impurities. (See Office Action ¶32.) Applicants note that Nakajima discloses a metal electrostatic chuck, not a ceramic substrate heater. A high purity layer is deposited on a conductive ceramic of the electrostatic chuck to prevent contamination of the substrate. Nakajima describes the high purity layer as alumina, silicon dioxide, silicon nitride, and sapphire. (See column 2, lines 28-30.) Nakajima also describes the high purity barrier layer as having an electric resistivity of not less than about 10^{12} Ω cm.

As Applicants noted in their previous response to the Office Action mailed June 4, 2007, Nakajima and Fukuda disclose devices having exactly opposite functions due, at least in part, to their reversed arrangement of material layers. Nakajima has a high purity layer with higher electrical resistivity than the metal base and Fukuda discloses a surface layer with a lower resistivity relative to the ceramic material. In addition, the difference in layering between the two references provide opposite functionality, which is understandable given the nearly reversed position of the layers. The Fukuda susceptor is designed to release substrates while the Nakajima electrostatic chuck is designed to electrostatically adhere substrates. Consequently, one skilled in

the art at the time of the invention would not modify Itatani in view of Kim in further view of Fukuda with what is disclosed in Nakajima. Applicants submit that Fukuda and Nakajima conflict to such a degree that they cannot be harmonized. The Examiner is merely selecting the respective portions of each and then inexplicably ties them together in an attempt to form an obviousness rejection.

In addition, the Examiner's reason for modifying Itatani in view of Kim in further view of Fukuda with Nakajima is confusing. If the Examiner means that the Nakajima high purity barrier layer is formed on Kim's silicon oxide layer then subsequent deposition of ruthenium-containing material (from Itatani) on the substrate covers the high purity barrier layer and the resulting modification still fails to suggest what Applicants have recited in claim 35. In sum, Nakajima does not cure the deficiencies of the alleged modification of Itatani in view of Kim in further view of Fukuda, nor does Examiner's reasoning for modification with what is disclosed in Nakajima cure the deficiencies of the rejection.

Then, the Examiner references Vaartstra for teaching deposition of $RuSi_x$. As the Examiner has indicated, Vaartstra discloses depositing $RuSi_x$ onto a substrate, specifically for use in electronic devices. In other words, none of the references of record suggest application of $RuSi_x$ layers for application on ceramic substrate heaters. Applicants submit that the Examiner's reasoning is again lacking, and, consequently, it does not support the obviousness rejection of claim 35.

First, Vaartstra does not cure the failure of the alleged modification of references as explained above. Vaartstra adds nothing to the string of references. Additionally, the Examiner's explanation fails to explain why one skilled in the art would make a mental leap from semiconductors structures to substrate heater. The Examiner states "it would have been obvious . . . to have modified the method taught by Itatani in view of Kim, Fukuda, and Nakajima by employing an $RuSi_x$ diffusion barrier layer formed as taught by Vaartstra as the specific barrier layer protective coating for the ceramic substrate heater protective coating with a reasonable

expectation of success, because Nakajima teaches that barrier layers may effectively be used to prevent backside contamination of semiconductor wafers from ceramic substrate heater . . . ." (See Office Action, ¶ 33.) Applicants again note that Nakajima discloses a metal electrostatic chuck, not a ceramic substrate heater. Additionally, in Nakajima, backside contamination is reduced by placing a high purity coating, which has a high resistivity (opposite of Fukuda), on a conductive ceramic such that substrates residing in contact with the high purity coating are not contaminated by the conductive ceramic. As explained above with regard to Nakajima, the Examiner does not explain why one skilled in the art would add a high purity barrier layer to the alleged modification of Itatani, nor does the Examiner explain where the high purity barrier layer would reside. While silicon oxide is generally not conductive, the only possible explanation would be to place a high purity barrier layer on the silicon oxide layer of Kim because Nakajima discloses forming the high purity barrier layer on a conductive ceramic. Even if one skilled in the art ignored the entire purpose of Nakajima and formed the high purity barrier layer on the silicon oxide, Itatani teaches that a ruthenium-containing layer is placed on the substrate holder prior to processing substrates. Consequently, substrates processed according to the Examiner's construction would still contact the ruthenium-containing layer. Finally, a rationale for why one skilled in the art would spontaneously replace a high purity barrier layer formed on a conductive ceramic with a $RuSi_x$ layer formed in semiconductor devices is entirely missing. For at least the above reasons, the Examiner has failed to establish a *prima facie* case of obviousness with respect to claim 35. Applicants respectfully request the rejections of claim 35 and claim 18 be withdrawn.

The Examiner rejects claim 32 under §103(a) as being unpatentable over Itatani in view of Kim, Fukuda, Nakajima and Vaartstra, and further in view of Marsh et al. U.S. Patent Application Publication No. 2002/0025627. Claim 32 is an independent claim. Claim 32 is currently amended to recite "prior to placing a substrate on the substrate heater." Applicants respectfully traverse the rejection.

To support an obvious rejection, there must be some articulated reasoning with some rational underpinning. (See M.P.E.P. §2143.) Here, the Examiner utilizes the same references in rejecting claim 35 and admits that the alleged combination of references does not teach the limitations that a Si layer is deposited on a Ru layer. The Examiner then references Marsh as inherently disclosing a Si layer deposited on a Ru layer because Marsh describes an ALD process. Applicants note that Marsh describes a method for use in the fabrication of integrated circuits. Specifically, Marsh describes a structure that includes a substrate assembly and a $RuSi_xO_y$-containing adhesion layer disposed on a surface of the substrate assembly. (See ¶[0027].) In addition to the arguments set forth above with respect to the rejection of claim 35, nothing in Marsh suggests application of layers to a ceramic substrate heater. Marsh does not cure the deficiencies in the alleged combination of Itatani, Kim, Fukuda, Nakajima, and Vaartstra. Furthermore, the Examiner's explanation for why one skilled in the art would modify the alleged combination with Marsh fails to cure the deficiencies of the prior reasoning for this string of references. For at least these additional reasons, the Examiner has failed to establish a *prima facie* case of obviousness. Applicants respectfully request withdrawal of the rejection.

The Examiner rejects claim 34 under §103(a) as being unpatentable over Itatani in view of Kim, Fukuda, Nakajima, Vaartstra, and Marsh, and further in view of Ravi. Claim 34 depends from claim 32. Applicants respectfully traverse the rejection.

In addition to the arguments set forth above with regard to the rejection of claim 32, Applicants submit that the addition of Ravi does not cure the deficiencies in the references of record, nor does Ravi somehow cure the deficiencies in the Examiner's reasoning for combining Itatani in view of Kim, Fukuda, Nakajima, Vaartstra, and Marsh. As Applicants stated in the rejection of amended claim 1, Ravi describes a diamond or diamond-like coating that resists cleaning gases. Each of the other references cited by the Examiner describe materials that are removable with the cleaning/etching gases used in semiconductor processing. The Examiner fails to provide a reason why one skilled in the art would modify the alleged combination with Ravi.

Specifically, no reason is provided as to why one skilled in the art would be motivated to ignore the entire purpose of the diamond coating of Ravi but would be motivated to reapply the integrated circuit layers of Vaartstra and Marsh onto a ceramic substrate heater. The Examiner has failed to assert the existence of any suggestion or motivation for making the alleged modification. The Examiner has, therefore, failed to provide a *prima facie* case of obviousness. Applicants respectfully request that the rejection of claim 34 be withdrawn.

CONCLUSION

In view of the foregoing amendments to the claims and remarks given herein, Applicants respectfully believe this case is in condition for allowance and respectfully request allowance of the pending claims. If the Examiner believes any detailed language of the claims requires further discussion, the Examiner is respectfully asked to telephone the undersigned attorney so that the matter may be promptly resolved. The Examiner's prompt attention to this matter is appreciated.

Applicants are of the opinion that no additional fee is due as a result of this Amendment. If any charges or credits are necessary to complete this communication, please apply them to Deposit Account No. 23-3000.

Respectfully submitted,

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